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KALINGA-APAYAO

KALINGA-APAYAO PROVINCE

THE SOILS OF KALINGA-APAYAO PROVINCE

The soils of Kalinga-Apayao maybe classified into four general groups based on their relief, namely: (1) soils of the plains and valleys; (2) soils of the [illegible] and plateaus; (3) soils of rolling hills and mountains; and (4) Miscellaneous land types.

Kalinga-Apayao is generally rough mountainous province comprising the northern portion of the Cordillera Mountains Range. The plains or level areas are roughly located in the western side bordering the province of Cagayan. Rock formation in the uplands and mountain areas are of sandstone and shale; igneous rocks, mostly of basalt and andesite; and a small area of limestone. In some areas the shale and sandstone are stratified in alternate layers.

SOILS OF THE PLAINS AND VALLEYS

The soils of the plains and valleys were formed from the deposition of washed down sediments from the adjoining mountains and through river depositions. They are mostly light soils, brown to almost black in color. These alluvial soils are fairly fertile to fertile and they constitute most of the agricultural areas of the province.

UMINGAN SERIES

Umingan soils are secondary soils developed from recent alluvium deposited by rivers and the surrounding uplands. They are deep soils, dark brown to very dark grayish brown with a distinct layer of river-wash stones in the lower horizons.

The relief is level to very slightly undulating with good to very good drainage conditions. It is extensively planted to lowland rice under communal irrigation. The elevated portions are planted to corn and some vegetables. Palay of the variety Ramined and Wag-wag planted to these soils gives an average yield of 60 to 70 cavans a hectare without fertilizers; shelled corn is 5 to 10 cavans.

Umingan soils were mostly mapped as the soils of Tabuk Valley from north of barrio Bulanao to the Laya Plains along the Chico River. Two soil types, Umingan sandy loam and the Umingan loam were mapped in this area under this series.

Umingan loam (322).- This soil type is irrigated from the Chico River by gravity by means of a simple diversion. It is extensively planted to lowland rice twice a year.

The surface soil is dark brown (10YR 3/3), very dark brown to very dark grayish brown (10YR 3/2); loam to sandy loam; loose and friable, fine granular; high in

organic matter content; easy to work and with good root penetration. It extends to a depth of 15 to 45 centimeters. The subsoil is sandy loam, loam to clay loam; dark brown (10YR 4/3) to very dark grayish brown. It is loose and friable to slightly compact; fine granular with reddish streaks. A layer of gravel and stones 20 to 48 centimeters thick is found in the lower subsoil. The depth is 60 to 30 centimeters from the surface. Below the layer of gravel and stones is yellowish brown to brown sandy loam to sand.

Umingan sandy loam (100).- Similar to Umingan loam, this soil type exhibits relatively the same characteristics. It differs only in the texture of the surface soil. It was mapped mostly as flood areas of the Chico River between its numerous river channels. It is also planted to lowland rice, corn and some vegetables.

SAN MANUEL, SERIES

Similar to the Umingan soils, San Manuel soils are also formed from recent alluvial deposits along the Chico River and Abulog River in Apayao Area. These soils are mostly mapped in the municipalities of Pudtol and Flora, with a very small area found in Tabuk town.

Soil areas of this series are level to nearly level with good drainage conditions. They are mostly planted

to corn and some vegetables with a limited area planted to lowland rice. These are productive soils with a wide crop adaptability.

Five soil types were mapped under this series.

San Manuel silt loam (82).- This soil type is mainly planted to corn, tobacco, peanut, beans and some vegetables. It is not covered by the Abuleg River Irrigation System. The surface soil is yellowish brown to brown; silt loam; loose and friable, fine granular; and extends to a depth of 30 to 35 centimeters. The subsoil to a depth of 80 to 100 centimeters from the surface is dark yellowish brown; silt loam to clay loam; granular with few mottlings. Below the subsoil is fine sand to sand.

San Manuel silty clay loam (94).- This was mostly mapped in the municipalities of Pudtol and Flora along the Abuleg River upstream. It is mainly planted to corn, tobacco and peanut with some areas planted to lowland rice. It is nearly level; loose and friable with good drainage. It is easily subjected to floods in which silty sediments are deposited especially during exceptionally heavy rains.

San Manuel sandy loam (96).- This was mapped as a very small area along the course of the Chico River in Tabuk. It is principally planted to corn with good yield. Tobacco and peanut are also grown.

The surface soil ranges in depth from 15 to 20 centimeters; dark brown to very dark brown; sandy loam; loose and friable. The subsoil is silt loam to sandy loam, very slightly compact but loose with good root penetration. It is very dark gray to yellowish brown with reddish brown streaks. Below is structureless sandy loam to sand; brown to dark grayish brown.

San Manuel loam (190).- Like the San Manuel sandy loam, this is a small area along the Chico River in Tabuk valley. It is a very deep soil, loose and friable, brown to dark grayish brown and high in organic matter content.

It is mainly planted to corn, peanut and some vegetables. The area could be planted to lowland rice during the rainy season.

San Manuel clay loam (236).- This is mapped as nearly level to level areas west of the Abulog River in the municipality of Pudtol. It is traversed by the Malumog, Tumog and Mangalisan Rivers all draining to the Abulog River. The soil is fairly to poorly drained externally but good to fair internally. It is a fairly productive soil and is being planted to lowland rice, corn and sugar cane with some vegetables. It could be planted intensively to lowland rice during the rainy season.

QUINGUA SERIES

Quingua soils are formed from the deposition of alluvial materials from the surrounding hills and rivers. It is similar to Umingan and San Manuel on this report but differs only on its having a heavier texture in the lower horizons.

The relief is level to nearly level with fair to good drainage conditions. They are fertile and productive soils with a wide range of crop adaptability. Three soil types were mapped under this series, namely; Quingua silt loam, Quingua clay loam, and Quingua silty clay loam.

Quingua silt loam (5).- This soil type was mapped in the municipalities of Pudtol and Luna in scattered areas along the Abulog River and its tributaries. Only a portion of this soil area is being planted to lowland rice; corn, tobacco and some vegetables; the rest are still under thick growth of underbrushes especially toward the upstream of the Abulog River. This soil type when fully developed could be planted to a wide variety of crops.

The surface soil is brown to light brown, loose and friable with some brownish streaks. It extends to as deep as 30 to 40 centimeters. The subsoil is light brown to reddish brown; clay loam; slightly compact and

sticky but friable when dry. The depth is from 70 to 80 centimeters from the surface. The substratum is yellowish brown; silty clay loam with light grayish mottling. It is slightly compact, plastic and sticky but friable when dry.

Quingua clay loam (109).- Soil areas of this soil type were mapped in small scattered patches along the meanders of rivers towards their lower streams. An extensive area was mapped along the Chico River in Tabuk, the Saltan River in Pinukpuk, along the Abulog River in Luna and Pudtol towns, and the Allig Plains of Flora towards Cagayan Province.

The surface soil is pale yellowish brown; slightly compact but loose and friable clay loam with reddish streaks. It extends to a depth of 15 to 25 centimeters. The subsoil is light brown to pale brown silt loam, loose and friable to slightly compact expanding to a depth of 70 to 80 centimeters from the surface. The substratum is yellowish to brown silt loam to clay loam.

A greater area under this soil type is still under second growth forest and thick growth of underbrushes. Portions being cultivated are planted to corn, tobacco, peanut, some vegetables and a limited area under lowland

rice. Quingua clay loam as mapped in the province is a potential agricultural land when fully opened. Some areas could be irrigated from the adjoining rivers for a good production of rice and some other irrigated row crops.

Quingua silty clay loam (28S).- Similar to the other Quingua soil types, Quingua silty clay loam was mapped on meanders of rivers. This is the soil type of the river valley of Baren and Nabbuangoa in Conner and a flood plain of the Abulog River in Flora and Sta. Marcela.

The surface soil is brown to yellowish brown; silty clay loam; slightly compact and sticky; loose and friable, fine granular when dry; contains some grayish brown mottlings. It extends to a depth of 20 to 25 centimeters. The subsoil is light brown to yellowish brown; clay loam to silt loam; slightly compact and sticky when wet but friable when dry. It ranges in depth from 80 to 100 centimeters from the surface. Below this layer is dark grayish brown with gray mottlings; silty clay; compact and sticky but breaks easily into fine to medium granular structure when dry or just moist.

Quingua silty clay loam soil is being extensively planted to corn, upland and lowland rice, tobacco, sugar cane; and with bananas, coffee and cacao in elevated areas. Production from these crops give good yield and

they supply the markets of Tuao to as far as Tuguegarao, Cagayan especially bananas and coffee. Lowland rice is also widely planted with some areas being irrigated from pumps. Crop yields may not be satisfactorily high but could be increased when properly attended and with the use of good varieties and improved cultural practices.

TORAN SERIES

Toran series was first found and described in barrio Toran, Aparri, Cagayan; hence, the name. It is the extensive lowland area along the coastal towns of Cagayan extending towards the northern plains of Kalinga-Apayao. It was mapped mostly in the municipalities of Lasa and Sta. Marcela.

Soils of the Toran series are recent alluvial deposits on a level relief. It has a heavy-textured, compact subsoil with poor external and internal drainage conditions. In some places, highly weathered sandstone are found in the substratum.

Only one soil type was identified under this series, the Toran silty clay.

Toran silty clay (567).- This is an alluvial soil of recent mode of deposition. It is on a level to nearly level relief with poor drainage that they are generally

planted or adapted to lowland rice. Coconuts and some fruit trees are widely planted in patches on the slightly elevated areas. This soil type is extensively irrigated by the Abulog River Irrigation System in the province of Cagayan. The dam of this irrigation system is located in the municipality of Pudtol, Kalinga-Apayao.

The surface soil is pale brown, brown to yellowish brown; silty clay; contains reddish to yellowish brown streaks; slightly sticky and plastic when wet but hard when dry; coarse granular with moderate amount of organic matter with numerous roots. Depth varies from 20 to 25 centimeters. The subsoil is yellowish-brown clay; contains reddish brown streaks; plastic and sticky but becomes hard and compact when dry. Depth is from 80 to 90 centimeters from the surface. Below the subsoil is light grey to yellowish brown; compact clay with yellowish mottlings. Few concretions are present.

ISABELA SERIES

The lowlands of Liwan consist of soils of the Isabela series. These are level lands from alluvial deposits from the surrounding uplands with poor drainage conditions. It is an extension of the same soil series mapped in the adjacent lowlands of Cagayan Province.

The surface soil is dark gray (10YR 4/4) to almost black; clay; massive to coarse granular; plastic and sticky when wet. Few rounded concretions are present. It contains moderate amount of organic matter. The depth ranges from 10 to 20 centimeters. The subsoil is grey (10YR 5/1) to dark yellowish brown (10YR 4/4) clay; very sticky and very plastic when wet, hard and compact when dry; contains few rounded concretions. Depth ranges from 60 to 80 centimeters from the surface. Below this layer is light brownish grey, stiff clay; very plastic and sticky when wet, hard and compact when dry.

This soil area is mainly planted to lowland rice giving a yield of as high as 60 cavans a hectare. A greater area is being covered by irrigation pumps from the nearby creeks. Corn and some vegetables are also planted on this soil type during the dry season.

BARCELONA SERIES

Barcelona soils are recent alluvial deposits from the surrounding uplands. They are developed on older alluvial plains with moderately developed profile and dense subsoils. They exist on nearly level to gently sloping relief with good external drainage but poor internal drainage condition.

Only one soil type was identified under this series, the Barcelona clay.

Luisiana clay (148).- This is a long strip of nearly level to gently sloping area mapped along the road is Bianpak in barrios Calanan to Magsogao, Tabuk. It hugs the low mountains west of the road and the Chico River.

A greater portion of this soil area is planted to lowland rice, rainfed, with an average yield of 35 cavans a hectare. Corn is also planted but on a limited scale. This soil type could also be planted to some vegetables, fruit trees, coffee and sugar cane. Second growth forest, talahib and cogon are the vegetative cover of the un-cultivated areas.

The surface soil from 10 to 20 centimeters is clay loam to clay; very dark greyish brown (2.5Y 3/2) to black (5YR 2/1); medium to coarse granular; plastic and sticky when wet; contains yellowish to reddish streaks; moderate organic matter content; and with good root penetration. The subsoil is clay; reddish brown (5YR 5/4) to gray (2.5Y 5/0) with yellowish brown streaks and few to numerous rounded concretions. It is compact and hard when dry, plastic and sticky when wet. This extends to a depth of 40 to 60 centimeters from the surface. The substratum is gray (2.5Y 6/0) to strong brown (7.5YR 5/0), massive clay, very plastic and sticky when wet, hard and compact when dry. Below this layer is highly weathered shale and sandstone.

SOILS OF THE UPLANDS AND PLATEAUS

The soils of the uplands and plateaus are derived from shale and sandstone. They are generally mainly to coarse textured soils ranging in color from brown to reddish brown. Typically, they are undulating to rolling with excessive external drainage.

Four soil series were classified under this group, namely the Nambaran, Alambon, Bantay and San Juan soils. Nambaran series was mapped on a plateau with soils developed from shaly sandstone. It is generally cultivated to lowland rice. Alamnos soils are characteristically red soils developed from basalts and andesites. They are mainly planted to coconuts and some fruit trees. San Juan soils are derived from weathered sandstone while Bantay soils are developed from shale. Upland rice and sugar cane are planted but with a greater area under cogon grass. The external drainage is good but with poor internal drainage conditions.

" NAMBARAN " SERIES

Nambaran series is a new soil series described during the survey of the province. It was named after barrio Nambaran in the Municipality of Tabuk. It is located along the road from Tabuk to Cagayan Province through the town of Liwan. The proposed tabuk airstrip is located on this soil series.

Mankaran soil was mapped mainly on the area commonly referred to as the "Tabak Plateaus". It is nearly level to undulating with poor drainage conditions. It is traversed by numerous streams and deep V and U-shaped gullies. Cultivated areas are being planted to lowland rice. A greater area is under grass with scattered patches of bushes and second growth forest mostly along creeks.

Centrally, Mankaran soils are dark yellowish brown, dark brown to dark gray with highly weathered shaly sandstone in the substratum. A typical soil profile is described below.

0 - 20 cms.- Dark yellowish brown (10YR 3/4) to very dark brown (10YR 2/2); sandy loam to silty clay loam; loose and friable; medium fine to fine granular; reddish streaks along root channels; few reddish brown to black concretions; clear and wavy, to

20 - 30 cms.- Dark brown (7.5YR 3/2); clay; loose and friable; coarse blocky to columnar; heavy, plastic and sticky when wet, hard when dry; contains reddish concretions of 5 mm. dia; diffused boundary, to

30 - 70 cms.- Dark gray (10YR 4/1); clay; massive and compact to columnar; hard when dry, plastic and very sticky when wet; weathered reddish

to black concretions present; whitish mottlings of weathered sandstone abundant; smooth, diffused boundary to

30 - cm. below - Grey (10YR 5/1); sandy clay; massive and compact; hard to extremely hard when dry, very plastic and very sticky when wet; contains numerous reddish to black, highly weathered concretions.

Busbaren soils differ from the Caoayan and Bago soils in that the former is developed from shaly sandstone with a general color of gray to dark grey; the latter soils are lighter in color.

ALAMINOS SERIES

Generally, Alaminos soils are deep, red to almost brick red in color, and developed in place from basalts and andesites. They exist mostly on rolling to mountainous areas with good to excessive drainage conditions.

Three soil types were mapped under this series in the province, namely; Alaminos loam (103); Alaminos clay loam (407), and Alaminos sandy clay loam (700).

<u>Alaminos loam</u> (103).- This soil type is an extension of the same soil area mapped in the province of Cagayan at the northern approach of Kalinga-Apayao. It was mapped west of the town of Luna to the [illegible] and [illegible] Rivers.

The surface soil is dark brown to reddish brown; loam; loose and friable, granular and slightly sticky when wet. It is high in organic matter content. The depth ranges from 23 to 25 centimeters. The subsoil is reddish brown; clayey slightly compact, to subangular to columnar blocky; plastic and sticky. It extends to as deep as 80 to 100 centimeters from the surface. The substratum is almost similar to subsoil.

Alaminos loam is mostly under secondary and primary growth forest. Patches of small clearings are being planted to upland rice and coconuts. This soil type could be planted extensively to coconuts and with some other crops as coffee, cocoa, kaymito and other fruit trees.

Alaminos clay loam (407).- This is a wider soil type of the series. It was entirely mapped as the rolling to mountain areas in the municipalities of Flora, Sta. Marcela, Pudtol and Luna.

The surface soil to a depth of 15 to 30 centimeters is dark reddish brown to almost brick red; clay loam; loose and friable, coarse granular; plastic and sticky when wet. It contains reddish brown mottlings and fairly high in organic matter content. The subsoil is reddish to yellowish brown to almost brick red; clayey; slightly compact to columnar blocky; plastic and sticky when wet; contains reddish streaks.

concretions are at times present. This extends to a depth of 70 to 90 centimeters from the surface. The substratum is almost similar to the upper horizons.

A greater area of the Alaminos clay loam soil is still under secondary and primary forest with thick under brushes. Cultivated portions are planted to coconuts and some fruit trees with good yield. This soil area when fully developed could be planted to a wide variety of crops owing to its deep soil. Coffee, cacao, bananas and some root crops could be grown in this soil type.

Alaminos sandy clay loam (706).- The small rolling area mapped in barrio Bugsong, Sta. Marcela was classified under this soil type. It slopes down to the foran and Quingua soils. It is mostly under patches of grasses and second growth forest. Only a small area is planted to coconuts and some fruit trees. Similar to the Alaminos clay loam it exhibits almost the same profile characteristics differing only in the texture of the surface soil. It is also adapted to a wide variety of crops when fully developed.

BANTAY SERIES

Soils of the Bantay series are developed from weathered shale. They are residual soils on upland areas with rolling to hilly relief. Their external drainage is excessive but poor internal drainage condition. The vegetation consists mostly of second growth forest and grasses with patches of

cultivations to upland rice, root crops, bananas and some vegetables.

Bantay clay loam was the only soil type mapped under this series.

Bantay clay loam (259).- This soil type was mapped extensively in the adjacent provinces of Cagayan with a small area delineated in this province as an extension area along the provincial boundary. It was mapped within the municipality of Flora.

Bantay clay loam has a surface soil ranging in depth from 10 to 15 centimeters. It is brown to greyish brown, loose and friable, fine granular clay loam. The subsoil is light brown to yellowish brown; hard and brittle to rubbly, clay to clay loam; plastic and sticky when wet. The lower depths contain weathered shale that easily breaks to cubes with some whitish precipitates. The subsoil extends to as deep as 40 to 70 centimeters from the surface. Below this layer is massive shale rock with some gravel.

This soil type was mapped as a hilly area with sparse second growth forest. Patches of cultivations are being planted to upland rice with some corn, root crops and vegetables also growing abundantly. Bantay clay loam soil area is highly erodible that its cultivation to some crops improperly may cause serious soil erosion damage.

SAN JUAN SERIES

San Juan soils mapped in the province is an extension of the same series found in the adjacent provinces of Bohol and Cagayan. It comprises the gently rolling to hilly areas along the provincial boundary in the municipalities of Lavan and Conner. It is a residual soil developed from weathered sandstone. The surface drainage is good to excessive with poor internal drainage condition. Only one soil type was mapped under this series, the San Juan clay.

San Juan clay (S74).- Most of the area under this soil type is under grasses. Cultivations are in patches and planted to corn and lowland rice in the small pockets of level areas. Some portions are covered by pasture lands. Drought-resistant crops and some fiber crops could be grown in this soil type.

The surface soil is clay to sandy clay loam; very dark brown (10YR 2/2) with very moderate amount of organic matter. It is plastic and sticky, medium to coarse granular and with good root penetration. It extends to as deep as 10 to 20 centimeters. The subsoil to as deep as 40 to 75 centimeters from the surface is clay to silty clay; dark greyish brown (10YR 4/2) to dark yellowish brown; hard and compact but breaks to coarse granular

structure; contains some concretions and gravel in some portions. It is plastic and sticky when wet. The substratum is yellowish brown, massive and stiff clay with highly weathered sandstone.

SOILS OF THE ROLLING HILLS AND MOUNTAINS

Soils under this group constitute the greater part of the soils of the province. Five soil series were mapped under this group; namely, Alimodian, Annam, Abonza, Bauang and Bolinao. These are mountain soils developed from various rocks mostly shale and sandstone; basalts and andesites, and limestone. Plenty of springs abound in these areas that the foot of the gentler hillsides are converted to rice terraces. The uncultivated areas are either under grass, second growth forest with some primary forest. Coffee is abundantly planted under these trees in clearings. Soil erosion is the dominant problem in this soil group where some parts are severely eroded.

ALIMODIAN SERIES

Soils of this series comprises the rolling to mountainous areas surrounding the Tabuk valley and plateaus. It extends to as far as the municipalities of Pinukpuk and Conner. It is an extensive soil area developed from

weathered shale and sandstone. Gravel, stones and sometimes boulders are found scattered on the surface. It is mostly under grass or cogon with patches of second growth forest and brushes along courses of intermittant streams. Erosion is so severe that some portions are bare rocks. The external drainage is excessive with good to fair internal drainage condition. Alimodian clay loam, Alimodian sandy clay and Alimodian sandy loam are the soil types identified under this series.

✓ Alimodian clay loam (126).- This was mapped as a wide strip of land from barrio Buluan at the provincial boundary at Lal-layog, Conner and Tuao, Cagayan; through the municipality of Pinukpuk to west of Tabuk. The municipality of Balbalan was also classified to be of this soil type. A greater area is under cogon and some grass species with second growth forest towards the municipality of Pinukpuk. The grassed areas are being utilized as pasture while clearings are being made in the forest areas and planted to upland rice. The gentler slopes of this soil area in Balbalan are made into rice terraces.

The surface soil is very dark grayish brown (10YR 3/2) clay loam; coarse granular to coarse angular blocky; loose and friable; plastic and sticky when wet; contains few to numerous gravel. It extends to a depth of 10 to 15 centimeters. The subsoil is yellowish brown; sandy clay; coarse

angular blocky; plastic and sticky when wet but hard when dry. It extends to a depth of 25 to 40 centimeters from the surface. Below this layer is slightly weathered platy shaly sandstone.

Alimodian sandy clay (225).- This is a similar area mapped at the southern boundary of the province bordering Iloilo on the east. The area is mostly under grass and covered by pasture leases. Cultivated areas are in small patches and mostly planted to cassava and some root crops. The area is severely eroded which is due to the scanty growth of vegetation.

Alimodian sandy loam (798).- Areas comprising this soil type are the low-lying mountains surrounding the municipality of Tubuh. It is an extensive area of platy to slightly stratified shale and sandstone with gravel, stones and sometimes boulders scattered on the surface. The vegetation consists mostly of cogon grass with patches of second growth forest along the courses of streams. The surface drainage is excessive but with fair to poor internal drainage condition. Soil erosion in this soil area is generally severe owing to the scanty vegetative cover, soil condition and relief.

Alimodian soils are rather shallow with the surface soil extending to as deep as 10 to 15 centimeters. The

color ranges from dark reddish gray (10R 3/1) to very dark brown (10YR 2/2); sandy loam; loose and friable; medium to coarse granular and brittle when dry. Stones, gravel and sometimes boulders are present on the surface. The subsoil to a depth of 40 to 60 centimeters from the surface is sandy clay, columnar blocky; plastic and sticky when wet. It ranges in color from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/8). The substratum is yellowish brown, highly weathered shale and sandstone, platy and sometimes stratified in formation.

Cultivated areas of this soil type are in patches found in small pockets of level to undulating relief planted to upland rice, corn and some root crops with a greater area under grass. Some drought-resistant crops may be grown in this soil type but preferably to be left as pasture or for reforestation.

AMBAN SERIES

The soils of the Amban series are developed from the weathering of igneous rocks mostly basalts and andesites. They are generally brown to light reddish brown in color with good to excessive drainage conditions. They ranges in relief from strongly rolling to mountainous with small patches of level to undulating areas.

The vegetative cover consists of grasses and second growth forest. Numerous springs abound within this soil group that the long, gentler slopes are converted into rice terraces with the needed water supplied by these springs. Coffee is abundantly grown in this soil and they grow luxuriantly with good yield. Cacao is also grown.

Aruan clay loam (96).- The strongly rolling to very steep mountains of Kalinga area were classified under this soil type. It was mapped extensively in the municipalities of Pasil, Lubuagan, Tinglayan and Tanudan towards the southern portion of the province. The soil area is traversed by numerous deep ravines and rivers withan greater area under second growth forest. Few to numerous boulders are found in the surface and embedded in the subsoil.

Aruan clay loam with a surface soil ranging in depth from 15 to 25 centimeters is dark greyish brown (10YR 4/2) to very dark brown (10YR 2/2); clay loam, fine to coarse granular, plastic and sticky and with good root penetration. It contains moderately high organic matter. The subsoil is yellowish brown (10YR 5/8) to dark gray (10YR 4/1); clay; coarse granular to medium course subangular blocky; loose and friable when dry, but plastic and sticky when wet. It contains some concretions and gravel. The depth ranges from 40 to 70 centimeters from the surface.

Below this layer is dark brown (7.5YR 3/2) to brownish yellow (10YR 6/8); clay to sandy clay; coarse subangular blocky to hard and compact; plastic and sticky; with stones and boulders embedded in this layer.

The above soil type is mainly under second growth forest and grasses. Coffee and cacao are mostly grown in this soil area.

Annam sandy clay loam (113).- Except for the texture of the surface soil, this soil type exhibits almost similar characteristics with that of the Annam clay loam. They are mostly mapped as rice terraces on the gentler slopes found mostly in the municipalities of Pasil, Lubungan, Tinglayan and Tanudan.

Lowland rice is mostly planted to these soil areas in terraces. Springs which abound along the mountain sides are diverted to the rice terraces for irrigation water. Some fruit trees with vegetables and other root crops are also planted.

Annam clay (339).- This is rather a small area mapped as level along the Chico River in barrio Nanong, Tabuk and Tocmangan, Pasil.

The surface soil is dark gray (10YR 4/1); clay; medium coarse granular; hard when dry, plastic and sticky when wet; contains few whitish concretions of weathered sandstone and yellowish brown mottlings. It extends to a depth of 10 to 15 centimeters. The subsoil is very dark brown (10YR 2/2);

heavy clay; hard when dry, plastic and sticky to compact when wet; contains reddish brown mottlings with whitish concretions. The depth ranges from 50 to 60 centimeters from the surface. Below the subsoil is very dark grayish brown; clay; fine granular to slightly compact; friable and slightly firm when just moist. Embedded in this layer are pebbles, gravel and stones.

Aroman clay is principally planted to lowland rice with irrigation water coming from adjacent springs. Local varieties are commonly planted with good yield. Other crops are also planted but on a very limited scale.

AROMAN SERIES

Aroman soils are developed from sedimentary rocks, mostly sandstone. Their relief is generally rolling to mountainous with primary and secondary forest cover. The drainage is good to excessive externally but fair to poor internally. Cultivation in this soil area are in patches and planted mostly to coconuts and some fruit trees. Coffee is planted in the gentler to rolling slopes. Only one soil type was mapped under this series.

Aroman clay loam (449).- This is an extensive soil area surrounding Kabugao town and along the Abulog River. It is with a rolling to mountainous relief and mostly under primary and secondary forest. The surface drainage is

excessive and with fair to poor internal drainage condition.

The surface soil to a depth of 30 centimeters is red (2.5YR 4/6) to reddish brown; clay loam; loose and friable, granular when moist; hard and brittle when dry; sticky and plastic when wet; contains few gravels. The subsoil is red (2.5YR 4/6); gritty clay; angular blocky; hard and brittle when dry, but plastic and sticky when wet. It extends to a depth of 70 to 100 centimeters from the surface. The substratum consists mostly of highly weathered sandstone and down below is massive sandstone.

The forested areas when cleared could be planted to coffee and coconuts with bananas on the gentler slopes. Upland rice could also be planted.

BAUANG SERIES

Soils of the Bauang series are developed from weathered shale and sandstone of stratified formation. They exist on a rolling, hilly to mountainous relief with a vegetative cover of mostly second growth forest. Primary forest and grass areas are in patches. The soils are generally brown with excessive surface drainage and fair internal drainage condition. One soil type was identified under this series.

Bauang clay loam (647).- The soils of the rolling to mountainous areas around the municipality of Gonner was classified as Bauang clay loam. The area is mostly under sparse growth of primary and secondary forest.

this oval area is being steadily opened through kaingins that soil erosion has set in to a serious state if unabated.

Cultivated crops consist mostly of upland rice, camanchile, fruit trees and some root crops. Coffee is also planted but on a limited scale.

The surface soil is dark brown (7.5YR 4/4); clay loam; loose and friable, coarse granular; plastic and sticky when wet, hard and brittle when dry. It contains some reddish mottlings. The depth ranges from 15 to 20 centimeters. The subsoil to a depth of 70 to 80 centimeters from the surface is brown (7.5YR 5/4) to strong brown; clay; angular blocky; plastic and sticky when wet, hard when dry. Highly weathered shale and sandstone are found embedded in this layer. Below the subsoil is highly weathered shale and sandstone in alternate stratified layers.

BOLINAO SERIES

The whole of barrio Pantikian in the municipality of Balboloan was mapped under the Bolinao soils. It is a small area with a hilly to mountainous relief. The external drainage is excessive but poor internally.

Bolinao clay loam is the only soil type mapped under this series.

Bolinao clay loam (10E).- The entire area around barrio Pantikian to the Bolton River comprises this soil type. It is a residual soil developed from limestone.

The vegetative cover is composed of second growth forest and grasses with primary forest in the steeper areas. Lowland rice is planted in terraces. Upland rice, bananas, cassava and some root crops are also planted abundantly.

Generally, the surface soil is 10 to 20 centimeters deep; brown to reddish brown; clay loam; coarse granular to hard and compact when dry; plastic and sticky when wet; with some weathered limestone (calcareous) found on the surface. The subsoil is clay to clay loam; contains limestone rocks of varying sizes; coarse, subangular blocky; hard and brittle when dry, but very sticky when wet. The substratum is made up of highly weathered calcareous limestone.

Colinao clay loam is highly fertile soil. A wide variety of agricultural crops could be planted in this soil area. However, fruit trees, coconuts and some permanent crops like coffee are best suited to this soil.

MISCELLANEOUS LAND TYPE

Soil areas classified under this group are considered of no immediate agricultural use. They may either be nearly inaccessible for orderly examination into any of the soil types, the area may have no true soil profile or have little or no natural soil, they may be gullied lands, or they may be swamps. Their topography is from nearly flat to hilly and mountainous.

Mountain soils, undifferentiated (45).- These are mountain areas that are nearly inaccessible for orderly examination. They are too steep and rugged and have no agricultural value for the immediate future. Some of these areas are under primary forest or under grasses.

The mountain lands in the northern portion of the province or Apayao Area are mostly covered by forest concessions and is the source of timber operation of the Bagyal Industries in Claveria, Cagayan. The undifferentiated soil area of the province comprises those bordering the western provincial boundary to the Ilocos provinces.